CLAIMS:

1. A method for one of delivering and withholding delivery of an extra-systolic stimulation cardiac pacing therapy, comprising:

sensing electrical activity of a heart to provide a heart rate signal for said heart;

correlating the heart rate signal and an extra-systolic interval for an extra-systolic stimulation therapy to a data set having at least a plurality of heart rates and a plurality of extra-systolic intervals; and

based on the correlation either delivering or inhibiting delivery of the extra extra-systolic stimulation therapy.

2. A method according to claim 1, wherein the data set includes empiric heart rate-based guidance for refractory period changes of a chamber of the heart for a plurality of heart rates.

3. A method according to claim 2, wherein the data set includes evoked response information, said information derived from measurements of an evoked response from the extra-systolic stimulation therapy, said information establishing, for at least one cardiac cycle, a refractory period of the chamber of the heart.

4. A method according to claim 3, wherein said information comprises at least one of: an evoked R-wave response, an evoked R-wave timing parameter, an evoked R-wave morphology characteristic, an evoked P-wave response, an evoked P-wave timing parameter, an evoked P-wave morphology characteristic, an evoked T-wave response, an evoked T-wave timing parameter, an evoked T-wave morphology characteristic, a ventricular pressure signal, an atrial pressure signal, a change of magnitude of a

maximum derivative of the ventricular pressure signal, a change of magnitude of a maximum derivative of the atrial pressure signal.

5. A method according to claim 1, wherein at least some of said plurality of correlated heart rates and extra-systolic intervals incorporate reduced extra-systolic intervals for a set of relatively higher heart rates.

6. A method according to claim 1, wherein at least some of said plurality of correlated heart rates and extra-systolic intervals incorporate increased extra-systolic intervals for a set of relatively lower heart rates.

7. A method according to claim 5, wherein said correlated heart rates and extra-systolic intervals incorporate a security-timing margin for a tachycardia induction portion of the data set.

8. A method according to claim 1, wherein the data sets incorporate information regarding a predicted degree or a measured degree of a stroke volume augmentation resulting from at least some discrete combinations of the correlated data sets.

9. A method according to claim 1, wherein at least some of the correlated data sets incorporate information regarding enhanced arrhythmia detection.

10. A method according to claim 9, wherein for at least some of the correlated data sets that include potential for a masked tachycardia rhythm, further comprising:

periodically withholding delivery of the extra-systolic stimulation therapy or decreasing the extra-systolic interval.

11. A method according to claim 9, further comprising:

intermittently withholding delivery of the extra-systolic stimulation therapy for at least one cardiac cycle for every N cardiac cycles to expose a masked tachycardia rhythms, wherein N comprises a non-zero integer.

12. A method according to claim 9, wherein the information regarding enhanced arrhythmia detection includes a reduced electrogram blanking period following delivery of a cardiac pacing stimulation pulse or an extra-systolic stimulation pulse.

13. A method according to claim 12, wherein the reduced electrogram blanking period includes a cross-chamber blanking period and a same-chamber blanking period.

14. A method according to claim 12, wherein the reduced blanking extends at least one arrhythmia sensing interval for at least a portion of relatively higher heart rates mapped to the table.

15. A method according to claim 1, wherein at least a portion of the correlated data sets incorporate information regarding a diastolic compromise condition.

16. A method according to claim 1, wherein for a plurality of relatively low heart rates: delivering the extra-systolic stimulation therapy for every cardiac cycle; and for a plurality of relatively high heart rates: withholding delivery of the extra-systolic stimulation therapy.

17. A method according to claim 16, further comprising:

applying an alternate paced heart rate during delivery of the extra-systolic stimulation therapy wherein the correlated data sets are disposed in, or proximate to, a region of a possibly masked tachycardia rhythm;

comparing the alternate paced heart rate to the correlated heart rate to determine if the alternate paced heart rate is about double or about half of the mapped heart rate; and

in the event that the alternate paced heart rate is about double or one-half of the mapped heart rate, withholding delivery of the extra-systolic stimulation therapy.

18. A method according to claim 17, further comprising:

applying an arrhythmia detection technique; and

in the event that an arrhythmia is detected, attempting to terminate the arrhythmia.

19. A method according to claim 18, wherein attempting to terminate the arrhythmia comprises at least a one of: providing an anti-tachycardia pacing therapy, providing a cardioversion therapy, providing a defibrillation therapy, providing a burst-type pacing therapy, providing a ramp-type pacing therapy.

20. A method for determining whether to deliver or withhold delivery of an extra-systolic stimulation cardiac pacing therapy, comprising:

sensing electrical activity of a heart to provide a heart rate signal for said heart;

obtaining a stored value of an extra-systolic stimulation pulse amplitude or a extra-systolic stimulation pulse duration for a ventricular-coupled extra-systolic stimulation therapy;

mapping the heart rate signal or an extra-systolic interval to the extra-systolic stimulation pulse amplitude or the extra-systolic stimulation pulse duration to a table containing at least a plurality of heart rates and a plurality of extra-systolic intervals; and

based on the mapped location on the table delivering, or inhibiting delivery of, the extra extra-systolic stimulation therapy.

21. A method according to claim 20, wherein a portion of the table includes information related to a reduced risk of tachycardia induction for a plurality of relatively high heart rates or a plurality of relatively short extra-systolic intervals based at least in part upon either the extra-systolic stimulation pulse amplitude or the extra-systolic stimulation pulse duration.

22. A method for initiating or gradually suspending delivery of an extra-systolic stimulation cardiac pacing therapy, comprising:

sensing electrical activity of a heart to provide a heart rate signal for said heart;

correlating the heart rate signal and an extra-systolic interval for an extra-systolic stimulation therapy to a therapy initiation-and-suspension table containing at least a plurality of heart rates and a plurality of extra-systolic intervals; and

based on the mapped location of the heart rate signal on the table and the mapped extra-systolic interval either delivering, or inhibiting delivery of, the extra extra-systolic stimulation therapy, wherein the therapy initiation-and-suspension table includes a plurality of therapy transition rules,

wherein one therapy transition rule provides a series of relatively long extra-systolic intervals compared to a cardiac cycle interval for a short period of time following initial delivery of the extra-systolic stimulation therapy and wherein said intervals are progressively shortened as the heart rate decreases during delivery of the extra-systolic stimulation therapy, or

wherein delivery of the extra-systolic stimulation therapy may not be suspended immediately in the event that the heart rate exceeds a pre-established heart rate limit.

23. A method according to claim 22, wherein the table includes empiric heart rate-based rules for refractory period changes of a chamber of the heart for a plurality of heart rates.

24. A method according to claim 22, wherein the table includes evoked response information, said information derived from measurements of an evoked response from the extra-systolic stimulation therapy, said information establishing, for at least one cardiac cycle, a refractory period of the chamber of the heart.

25. A method according to claim 24, wherein said information comprises at least a one of: an evoked R-wave response, an evoked R-wave timing parameter, an evoked R-wave morphology characteristic, an evoked P-wave response, an evoked P-wave timing parameter, an evoked P-wave morphology characteristic, an evoked T-wave response, an evoked T-wave timing parameter, an evoked T-wave morphology characteristic, a ventricular pressure signal, an atrial pressure signal, a change of magnitude of a maximum derivative of the ventricular pressure signal, a change of magnitude of a maximum derivative of the atrial pressure signal.

25. A method according to claim 25, wherein in the event that the heart comprises a part of a chronotropically incompetent hemodynamic system and further comprising:

reducing a rate responsiveness characteristic relative to a detected patient activity signal, so that the resulting rate response slope for a chronotropically incompetent hemodynamic system reflects a wider range of enhanced hemodynamic function over a wider range of heart rates.

26. A computer readable medium for causing a programmable processor to perform a method of delivering or withholding delivery of an extra-systolic stimulation therapy, comprising:

instructions for sensing electrical activity of a heart to provide a heart rate signal for said heart;

instructions for mapping the heart rate signal and an extra-systolic interval for an extra-systolic stimulation therapy to a table containing at least a plurality of heart rates and a plurality of extra-systolic intervals; and

based on the location on the table of the mapped heart rate signal and the mapped extra-systolic interval either instructions for delivering, or inhibiting delivery of, the extra extra-systolic stimulation therapy.

27. A medium according to claim 26, wherein the table includes empiric heart rate-based rules for refractory period changes of a chamber of the heart for a plurality of heart rates.

28. A medium according to claim 27, wherein the table includes evoked response information, said information derived from measurements of an evoked response from the extra-systolic stimulation therapy, said information establishing, for at least one cardiac cycle, a refractory period of the chamber of the heart.

29. A medium according to claim 28, wherein said information comprises at least a one of: an evoked R-wave response, an evoked R-wave timing parameter, an evoked R-wave morphology characteristic, an evoked P-wave response, an evoked P-wave timing parameter, an evoked P-wave morphology characteristic, an evoked T-wave response, an evoked T-wave timing parameter, an evoked T-wave morphology characteristic, a ventricular pressure signal, an atrial pressure signal, a change of magnitude of a maximum derivative of the ventricular pressure signal, a change of magnitude of a maximum derivative of the atrial pressure signal.

30. A medium according to claim 26, wherein at least some of said plurality of mapped heart rates and extra-systolic intervals incorporate reduced extra-systolic intervals in the event that the heart rate increases.

31. A medium according to claim 26, wherein at least some of said plurality of mapped heart rates and extra-systolic intervals incorporate increased extra-systolic intervals in the event that the heart rate decreases.

32. A medium according to claim 30, wherein said mapped heart rates and extra-systolic intervals incorporate a security-timing margin for a tachycardia induction portion of the table.

33. A medium according to claim 26, wherein at least a portion of the mapped location of the table incorporates information regarding a predicted degree or a measured degree of a stroke volume augmentation resulting from the extra-systolic stimulation therapy.

34. A medium according to claim 26, wherein at least a portion of the mapped locations of the table incorporates information regarding enhanced arrhythmia detection.

35. A medium according to claim 34, wherein in the event that the portion of the mapped locations of the table include potential for a masked tachycardia rhythm, comprising executing either instructions for periodically withholding delivery of the extra-systolic stimulation therapy or instructions for decreasing the extra-systolic interval.

36. A method of extra-systolic therapy delivery to a patient suffering from heart failure, comprising:

substantially continuously delivering an extra-systolic stimulation therapy to at least one cardiac chamber of a heart failure patient.

37. A system for delivering or withholding delivery of an extra-systolic stimulation cardiac pacing therapy, comprising:

means for sensing electrical activity of a heart to provide a heart rate signal for said heart;

means for correlating the heart rate signal and an extra-systolic interval for an extra-systolic stimulation therapy to a data set having at least a plurality of heart rates and a plurality of extra-systolic intervals; and

based on the correlation either delivering or inhibiting delivery of the extra extra-systolic stimulation therapy.

37. A system according to claim 38, wherein the data set includes empiric heart rate-based guidance for refractory period changes of a chamber of the heart for a plurality of heart rates.

38. A system according to claim 37, wherein the data set includes evoked response information, said information derived from measurements of an evoked response from the extra-systolic stimulation therapy, said information establishing, for at least one cardiac cycle, a refractory period of the chamber of the heart.

39. A system according to claim 38, wherein said information comprises at least one of: an evoked R-wave response, an evoked R-wave timing parameter, an evoked R-wave morphology characteristic, an evoked P-wave response, an evoked P-wave timing parameter, an evoked P-wave morphology characteristic, an evoked T-wave response, an evoked T-wave timing parameter, an evoked T-wave morphology characteristic, a ventricular pressure signal, an atrial pressure signal, a change of magnitude of a maximum derivative of the ventricular pressure signal, a change of magnitude of a maximum derivative of the atrial pressure signal.

40. A system according to claim 37, wherein at least some of said plurality of correlated heart rates and extra-systolic intervals incorporate reduced extra-systolic intervals for a set of relatively higher heart rates.

41. A system according to claim 37, wherein at least some of said plurality of correlated heart rates and extra-systolic intervals incorporate increased extra-systolic intervals for a set of relatively lower heart rates.

42. A system according to claim 41, wherein said correlated heart rates and extra-systolic intervals incorporate a security-timing margin for a tachycardia induction portion of the data set.

43. A system according to claim 37, wherein the data sets incorporate information regarding a predicted degree or a measured degree of a stroke volume augmentation resulting from at least some discrete combinations of the correlated data sets.

44. A system according to claim 37, wherein at least some of the correlated data sets incorporate information regarding enhanced arrhythmia detection.

45. A system according to claim 44, wherein for at least some of the correlated data sets that include potential for a masked tachycardia rhythm, further comprising:

means for periodically withholding delivery of the extra-systolic stimulation therapy or decreasing the extra-systolic interval.

46. A system according to claim 44, further comprising:
means for intermittently withholding delivery of the extra-systolic stimulation therapy for at least one cardiac cycle for every N cardiac cycles to expose a masked tachycardia rhythms, wherein N comprises a non-zero integer.

45. A system according to claim 44, wherein the information regarding enhanced arrhythmia detection includes a reduced electrogram blanking

period following delivery of a cardiac pacing stimulation pulse or an extra-systolic stimulation pulse.

46. A system according to claim 45, wherein the reduced electrogram blanking period includes a cross-chamber blanking period and a same-chamber blanking period.

47. A system according to claim 45, wherein the reduced blanking extends at least one arrhythmia sensing interval for at least a portion of relatively higher heart rates mapped to the table.

48. A system according to claim 37, wherein at least a portion of the correlated data sets incorporate information regarding a diastolic compromise condition.

49. A system according to claim 37, further comprising: for a plurality of relatively low heart rates, means for delivering the extra-systolic stimulation therapy for every cardiac cycle; and for a plurality of relatively high heart rates, means for withholding delivery of the extra-systolic stimulation therapy.

50. A system according to claim 49, further comprising:

means for applying an alternate paced heart rate during delivery of the extra-systolic stimulation therapy wherein the correlated data sets are disposed in, or proximate to, a region of a possibly masked tachycardia rhythm;

means for comparing the alternate paced heart rate to the correlated heart rate to determine if the alternate paced heart rate is about double or about half of the mapped heart rate; and

in the event that the alternate paced heart rate is about double or one-half of the mapped heart rate, means for withholding delivery of the extra-systolic stimulation therapy.

51. A system according to claim 50, further comprising:
means for applying an arrhythmia detection technique; and
in the event that an arrhythmia is detected, means for attempting to terminate the arrhythmia.

52. A method according to claim 51, wherein the means for attempting to terminate the arrhythmia comprises at least a one of: means for providing an anti-tachycardia pacing therapy, means for providing a cardioversion therapy, means for providing a defibrillation therapy, means for providing a burst-type pacing therapy, means for providing a ramp-type pacing therapy.